

## SEQUENCE LISTING

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<120> Lipolytic enzyme variants

<130> 10470.204-US

<160> 14

<170> PatentIn version 3.3

<210> 1

<211> 269

<212> PRT

<213> Thermomyces lanuginosus

<400> 1

Glu Val Ser Gln Asp Leu Phe Asn Gln Phe Asn Leu Phe Ala Gln Tyr  
1 5 10 15

Ser Ala Ala Ala Tyr Cys Gly Lys Asn Asn Asp Ala Pro Ala Gly Thr  
20 25 30

Asn Ile Thr Cys Thr Gly Asn Ala Cys Pro Glu Val Glu Lys Ala Asp  
35 40 45

Ala Thr Phe Leu Tyr Ser Phe Glu Asp Ser Gly Val Gly Asp Val Thr  
50 55 60

Gly Phe Leu Ala Leu Asp Asn Thr Asn Lys Leu Ile Val Leu Ser Phe  
65 70 75 80

Arg Gly Ser Arg Ser Ile Glu Asn Trp Ile Gly Asn Leu Asn Phe Asp  
85 90 95

Leu Lys Glu Ile Asn Asp Ile Cys Ser Gly Cys Arg Gly His Asp Gly  
100 105 110

Phe Thr Ser Ser Trp Arg Ser Val Ala Asp Thr Leu Arg Gln Lys Val  
115 120 125

Glu Asp Ala Val Arg Glu His Pro Asp Tyr Arg Val Val Phe Thr Gly

130

135

140

His Ser Leu Gly Gly Ala Leu Ala Thr Val Ala Gly Ala Asp Leu Arg  
145 150 155 160

Gly Asn Gly Tyr Asp Ile Asp Val Phe Ser Tyr Gly Ala Pro Arg Val  
165 170 175

Gly Asn Arg Ala Phe Ala Glu Phe Leu Thr Val Gln Thr Gly Gly Thr  
180 185 190

Leu Tyr Arg Ile Thr His Thr Asn Asp Ile Val Pro Arg Leu Pro Pro  
195 200 205

Arg Glu Phe Gly Tyr Ser His Ser Ser Pro Glu Tyr Trp Ile Lys Ser  
210 215 220

Gly Thr Leu Val Pro Val Thr Arg Asn Asp Ile Val Lys Ile Glu Gly  
225 230 235 240

Ile Asp Ala Thr Gly Gly Asn Asn Gln Pro Asn Ile Pro Asp Ile Pro  
245 250 255

Ala His Leu Trp Tyr Phe Gly Leu Ile Gly Thr Cys Leu  
260 265

<210> 2

<211> 286

<212> PRT

<213> Fusarium oxysporum

<400> 2

Ala Val Gly Val Thr Thr Thr Asp Phe Ser Asn Phe Lys Phe Tyr Ile  
1 5 10 15

Gln His Gly Ala Ala Ala Tyr Cys Asn Ser Glu Ala Ala Ala Gly Ser  
20 25 30

Lys Ile Thr Cys Ser Asn Asn Gly Cys Pro Thr Val Gln Gly Asn Gly  
35 40 45

Ala Thr Ile Val Thr Ser Phe Val Gly Ser Lys Thr Gly Ile Gly Gly  
50 55 60

Tyr Val Ala Thr Asp Ser Ala Arg Lys Glu Ile Val Val Ser Phe Arg  
65 70 75 80

Gly Ser Ile Asn Ile Arg Asn Trp Leu Thr Asn Leu Asp Phe Gly Gln  
85 90 95

Glu Asp Cys Ser Leu Val Ser Gly Cys Gly Val His Ser Gly Phe Gln  
100 105 110

Arg Ala Trp Asn Glu Ile Ser Ser Gln Ala Thr Ala Ala Val Ala Ser  
115 120 125

Ala Arg Lys Ala Asn Pro Ser Phe Asn Val Ile Ser Thr Gly His Ser  
130 135 140

Leu Gly Gly Ala Val Ala Val Leu Ala Ala Ala Asn Leu Arg Val Gly  
145 150 155 160

Gly Thr Pro Val Asp Ile Tyr Thr Tyr Gly Ser Pro Arg Val Gly Asn  
165 170 175

Ala Gln Leu Ser Ala Phe Val Ser Asn Gln Ala Gly Gly Glu Tyr Arg  
180 185 190

Val Thr His Ala Asp Asp Pro Val Pro Arg Leu Pro Pro Leu Ile Phe  
195 200 205

Gly Tyr Arg His Thr Thr Pro Glu Phe Trp Leu Ser Gly Gly Gly Gly  
210 215 220

Asp Lys Val Asp Tyr Thr Ile Ser Asp Val Lys Val Cys Glu Gly Ala  
225 230 235 240

Ala Asn Leu Gly Cys Asn Gly Gly Thr Leu Gly Leu Asp Ile Ala Ala  
245 250 255

His Leu His Tyr Phe Gln Ala Thr Asp Ala Cys Asn Ala Gly Gly Phe  
260 265 270

Ser Trp Arg Arg Tyr Arg Ser Ala Glu Ser Val Asp Lys Arg  
275 280 285

<210> 3  
 <211> 265  
 <212> PRT  
 <213> Absidia reflexa

<400> 3

Ser Ser Ser Ser Thr Gln Asp Tyr Arg Ile Ala Ser Glu Ala Glu Ile  
 1 5 10 15

Lys Ala His Thr Phe Tyr Thr Ala Leu Ser Ala Asn Ala Tyr Cys Arg  
 20 25 30

Thr Val Ile Pro Gly Gly Arg Trp Ser Cys Pro His Cys Gly Val Ala  
 35 40 45

Ser Asn Leu Gln Ile Thr Lys Thr Phe Ser Thr Leu Ile Thr Asp Thr  
 50 55 60

Asn Val Leu Val Ala Val Gly Glu Lys Glu Lys Thr Ile Tyr Val Val  
 65 70 75 80

Phe Arg Gly Thr Ser Ser Ile Arg Asn Ala Ile Ala Asp Ile Val Phe  
 85 90 95

Val Pro Val Asn Tyr Pro Pro Val Asn Gly Ala Lys Val His Lys Gly  
 100 105 110

Phe Leu Asp Ser Tyr Asn Glu Val Gln Asp Lys Leu Val Ala Glu Val  
 115 120 125

Lys Ala Gln Leu Asp Arg His Pro Gly Tyr Lys Ile Val Val Thr Gly  
 130 135 140

His Ser Leu Gly Gly Ala Thr Ala Val Leu Ser Ala Leu Asp Leu Tyr  
 145 150 155 160

His His Gly His Ala Asn Ile Glu Ile Tyr Thr Gln Gly Gln Pro Arg  
 165 170 175

Ile Gly Thr Pro Ala Phe Ala Asn Tyr Val Ile Gly Thr Lys Ile Pro  
 180 185 190

Tyr Gln Arg Leu Val His Glu Arg Asp Ile Val Pro His Leu Pro Pro  
 195 200 205

Gly Ala Phe Gly Phe Leu His Ala Gly Glu Glu Phe Trp Ile Met Lys  
 210 215 220

Asp Ser Ser Leu Arg Val Cys Pro Asn Gly Ile Glu Thr Asp Asn Cys  
 225 230 235 240

Ser Asn Ser Ile Val Pro Phe Thr Ser Val Ile Asp His Leu Ser Tyr  
 245 250 255

Leu Asp Met Asn Thr Gly Leu Cys Leu  
 260 265

<210> 4  
 <211> 264  
 <212> PRT  
 <213> Absidia corymbifera

<400> 4

Ser Ser Ser Thr Gln Asp Tyr Arg Ile Ala Ser Glu Ala Glu Ile Lys  
 1 5 10 15

Ala His Thr Phe Tyr Thr Ala Leu Ser Ala Asn Ala Tyr Cys Arg Thr  
 20 25 30

Val Ile Pro Gly Gly Gln Trp Ser Cys Pro His Cys Asp Val Ala Pro  
 35 40 45

Asn Leu Asn Ile Thr Lys Thr Phe Thr Thr Leu Ile Thr Asp Thr Asn  
 50 55 60

Val Leu Val Ala Val Gly Glu Asn Glu Lys Thr Ile Tyr Val Val Phe  
 65 70 75 80

Arg Gly Thr Ser Ser Ile Arg Asn Ala Ile Ala Asp Ile Val Phe Val  
 85 90 95

Pro Val Asn Tyr Pro Pro Val Asn Gly Ala Lys Val His Lys Gly Phe  
 100 105 110

Leu Asp Ser Tyr Asn Glu Val Gln Asp Lys Leu Val Ala Glu Val Lys  
 115 120 125

Ala Gln Leu Asp Arg His Pro Gly Tyr Lys Ile Val Val Thr Gly His  
 130 135 140

Ser Leu Gly Gly Ala Thr Ala Val Leu Ser Ala Leu Asp Leu Tyr His  
 145 150 155 160

His Gly His Asp Asn Ile Glu Ile Tyr Thr Gln Gly Gln Pro Arg Ile  
 165 170 175

Gly Thr Pro Glu Phe Ala Asn Tyr Val Ile Gly Thr Lys Ile Pro Tyr  
 180 185 190

Gln Arg Leu Val Asn Glu Arg Asp Ile Val Pro His Leu Pro Pro Gly  
 195 200 205

Ala Phe Gly Phe Leu His Ala Gly Glu Glu Phe Trp Ile Met Lys Asp  
 210 215 220

Ser Ser Leu Arg Val Cys Pro Asn Gly Ile Glu Thr Asp Asn Cys Ser  
 225 230 235 240

Asn Ser Ile Val Pro Phe Thr Ser Val Ile Asp His Leu Ser Tyr Leu  
 245 250 255

Asp Met Asn Thr Gly Leu Cys Leu  
 260

<210> 5  
 <211> 269  
 <212> PRT  
 <213> Rhizomucor miehei

<400> 5

Ser Ile Asp Gly Gly Ile Arg Ala Ala Thr Ser Gln Glu Ile Asn Glu  
 1 5 10 15

Leu Thr Tyr Tyr Thr Thr Leu Ser Ala Asn Ser Tyr Cys Arg Thr Val  
 20 25 30

Ile Pro Gly Ala Thr Trp Asp Cys Ile His Cys Asp Ala Thr Glu Asp  
 35 40 45

Leu Lys Ile Ile Lys Thr Trp Ser Thr Leu Ile Tyr Asp Thr Asn Ala  
 50 55 60

Met Val Ala Arg Gly Asp Ser Glu Lys Thr Ile Tyr Ile Val Phe Arg  
65 70 75 80

Gly Ser Ser Ser Ile Arg Asn Trp Ile Ala Asp Leu Thr Phe Val Pro  
85 90 95

Val Ser Tyr Pro Pro Val Ser Gly Thr Lys Val His Lys Gly Phe Leu  
100 105 110

Asp Ser Tyr Gly Glu Val Gln Asn Glu Leu Val Ala Thr Val Leu Asp  
115 120 125

Gln Phe Lys Gln Tyr Pro Ser Tyr Lys Val Ala Val Thr Gly His Ser  
130 135 140

Leu Gly Gly Ala Thr Ala Leu Leu Cys Ala Leu Asp Leu Tyr Gln Arg  
145 150 155 160

Glu Glu Gly Leu Ser Ser Ser Asn Leu Phe Leu Tyr Thr Gln Gly Gln  
165 170 175

Pro Arg Val Gly Asp Pro Ala Phe Ala Asn Tyr Val Val Ser Thr Gly  
180 185 190

Ile Pro Tyr Arg Arg Thr Val Asn Glu Arg Asp Ile Val Pro His Leu  
195 200 205

Pro Pro Ala Ala Phe Gly Phe Leu His Ala Gly Glu Glu Tyr Trp Ile  
210 215 220

Thr Asp Asn Ser Pro Glu Thr Val Gln Val Cys Thr Ser Asp Leu Glu  
225 230 235 240

Thr Ser Asp Cys Ser Asn Ser Ile Val Pro Phe Thr Ser Val Leu Asp  
245 250 255

His Leu Ser Tyr Phe Gly Ile Asn Thr Gly Leu Cys Thr  
260 265

<210> 6  
<211> 271  
<212> PRT

<213> Rhizopus oryzae

<400> 6

Ser Ala Ser Asp Gly Gly Lys Val Val Ala Ala Thr Thr Ala Gln Ile  
1 5 10 15

Gln Glu Phe Thr Lys Tyr Ala Gly Ile Ala Ala Thr Ala Tyr Cys Arg  
20 25 30

Ser Val Val Pro Gly Asn Lys Trp Asp Cys Val Gln Cys Gln Lys Trp  
35 40 45

Val Pro Asp Gly Lys Ile Ile Thr Thr Phe Thr Ser Leu Leu Ser Asp  
50 55 60

Thr Asn Gly Tyr Val Leu Arg Ser Asp Lys Gln Lys Thr Ile Tyr Leu  
65 70 75 80

Val Phe Arg Gly Thr Asn Ser Phe Arg Ser Ala Ile Thr Asp Ile Val  
85 90 95

Phe Asn Phe Ser Asp Tyr Lys Pro Val Lys Gly Ala Lys Val His Ala  
100 105 110

Gly Phe Leu Ser Ser Tyr Glu Gln Val Val Asn Asp Tyr Phe Pro Val  
115 120 125

Val Gln Glu Gln Leu Thr Ala His Pro Thr Tyr Lys Val Ile Val Thr  
130 135 140

Gly His Ser Leu Gly Gly Ala Gln Ala Leu Leu Ala Gly Met Asp Leu  
145 150 155 160

Tyr Gln Arg Glu Pro Arg Leu Ser Pro Lys Asn Leu Ser Ile Phe Thr  
165 170 175

Val Gly Gly Pro Arg Val Gly Asn Pro Thr Phe Ala Tyr Tyr Val Glu  
180 185 190

Ser Thr Gly Ile Pro Phe Gln Arg Thr Val His Lys Arg Asp Ile Val  
195 200 205

Pro His Val Pro Pro Gln Ser Phe Gly Phe Leu His Pro Gly Val Glu



210                      215                      220  
 Ser Trp Ile Lys Ser Gly Thr Ser Asn Val Gln Ile Cys Thr Ser Glu  
 225                      230                      235                      240  
  
 Ile Glu Thr Lys Asp Cys Ser Asn Ser Ile Val Pro Phe Thr Ser Ile  
                     245                      250                      255  
  
 Leu Asp His Leu Ser Tyr Phe Asp Ile Asn Glu Gly Ser Cys Leu  
                     260                      265                      270  
  
 <210> 7  
 <211> 267  
 <212> PRT  
 <213> Aspergillus niger  
  
 <400> 7  
  
 Thr Ala Gly Gln Ala Leu Ala Ala Ser Thr Gln Gly Ile Ser Glu Asp  
 1                      5                      10                      15  
  
 Leu Tyr Asn Arg Leu Val Glu Met Ala Thr Ile Ser Gln Ala Ala Tyr  
                     20                      25                      30  
  
 Ala Asp Leu Cys Asn Ile Pro Ser Thr Ile Ile Lys Gly Glu Lys Ile  
                     35                      40                      45  
  
 Tyr Asn Ala Gln Thr Asp Ile Asn Gly Trp Ile Leu Arg Asp Asp Thr  
                     50                      55                      60  
  
 Ser Lys Glu Ile Ile Thr Val Phe Arg Gly Thr Gly Ser Asp Thr Asn  
 65                      70                      75                      80  
  
 Leu Gln Leu Asp Thr Asn Tyr Thr Leu Thr Pro Phe Asp Thr Leu Pro  
                     85                      90                      95  
  
 Gln Cys Asn Asp Cys Glu Val His Gly Gly Tyr Tyr Ile Gly Trp Ile  
                     100                      105                      110  
  
 Ser Val Gln Asp Gln Val Glu Ser Leu Val Lys Gln Gln Ala Ser Gln  
                     115                      120                      125  
  
 Tyr Pro Asp Tyr Ala Leu Thr Val Thr Gly His Ser Leu Gly Ala Ser  
                     130                      135                      140

Met Ala Ala Leu Thr Ala Ala Gln Leu Ser Ala Thr Tyr Asp Asn Val  
 145 150 155 160

Arg Leu Tyr Thr Phe Gly Glu Pro Arg Ser Gly Asn Gln Ala Phe Ala  
 165 170 175

Ser Tyr Met Asn Asp Ala Phe Gln Val Ser Ser Pro Glu Thr Thr Gln  
 180 185 190

Tyr Phe Arg Val Thr His Ser Asn Asp Gly Ile Pro Asn Leu Pro Pro  
 195 200 205

Ala Asp Glu Gly Tyr Ala His Gly Gly Val Glu Tyr Trp Ser Val Asp  
 210 215 220

Pro Tyr Ser Ala Gln Asn Thr Phe Val Cys Thr Gly Asp Glu Val Gln  
 225 230 235 240

Cys Cys Glu Ala Gln Gly Gly Gln Gly Val Asn Asp Ala His Thr Thr  
 245 250 255

Tyr Phe Gly Met Thr Ser Gly Ala Cys Thr Trp  
 260 265

<210> 8  
 <211> 266  
 <212> PRT  
 <213> Aspergillus tubingensis

<400> 8

Thr Ala Gly His Ala Leu Ala Ala Ser Thr Gln Gly Ile Ser Glu Asp  
 1 5 10 15

Leu Tyr Ser Arg Leu Val Glu Met Ala Thr Ile Ser Gln Ala Ala Tyr  
 20 25 30

Ala Asp Leu Cys Asn Ile Pro Ser Thr Ile Ile Lys Gly Glu Lys Ile  
 35 40 45

Tyr Asn Ser Gln Thr Asp Ile Asn Gly Trp Ile Leu Arg Asp Asp Ser  
 50 55 60

Ser Lys Glu Ile Ile Thr Val Phe Arg Gly Thr Gly Ser Asp Thr Asn

65		70		75		80									
Leu	Gln	Leu	Asp	Thr	Asn	Tyr	Thr	Leu	Thr	Pro	Phe	Asp	Thr	Leu	Pro
				85					90					95	
Gln	Cys	Asn	Ser	Cys	Glu	Val	His	Gly	Gly	Tyr	Tyr	Ile	Gly	Trp	Ile
			100					105					110		
Ser	Val	Gln	Asp	Gln	Val	Glu	Ser	Leu	Val	Gln	Gln	Gln	Val	Ser	Gln
		115					120					125			
Phe	Pro	Asp	Tyr	Ala	Leu	Thr	Val	Thr	Gly	His	Ser	Leu	Gly	Ala	Ser
	130					135					140				
Leu	Ala	Ala	Leu	Thr	Ala	Ala	Gln	Leu	Ser	Ala	Thr	Tyr	Asp	Asn	Ile
145					150					155					160
Arg	Leu	Tyr	Thr	Phe	Gly	Glu	Pro	Arg	Ser	Asn	Gln	Ala	Phe	Ala	Ser
				165					170					175	
Tyr	Met	Asn	Asp	Ala	Phe	Gln	Ala	Ser	Ser	Pro	Asp	Thr	Thr	Gln	Tyr
			180					185					190		
Phe	Arg	Val	Thr	His	Ala	Asn	Asp	Gly	Ile	Pro	Asn	Leu	Pro	Pro	Ala
		195					200					205			
Asp	Glu	Gly	Tyr	Ala	His	Gly	Val	Val	Glu	Tyr	Trp	Ser	Val	Asp	Pro
	210					215					220				
Tyr	Ser	Ala	Gln	Asn	Thr	Phe	Val	Cys	Thr	Gly	Asp	Glu	Val	Gln	Cys
225					230					235					240
Cys	Glu	Ala	Gln	Gly	Gly	Gln	Gly	Val	Asn	Asn	Ala	His	Thr	Thr	Tyr
				245					250					255	
Phe	Gly	Met	Thr	Ser	Gly	His	Cys	Thr	Trp						
			260					265							

<210> 9  
 <211> 273  
 <212> PRT  
 <213> Fusarium heterosporum  
 <400> 9

Thr 1	Val	Thr	Thr	Gln 5	Asp	Leu	Ser	Asn	Phe 10	Arg	Phe	Tyr	Leu	Gln 15	His
Ala	Asp	Ala	Ala 20	Tyr	Cys	Asn	Phe	Asn 25	Thr	Ala	Val	Gly	Lys 30	Pro	Val
His	Cys	Ser 35	Ala	Gly	Asn	Cys	Pro 40	Asp	Ile	Glu	Lys	Asp 45	Ala	Ala	Ile
Val	Val 50	Gly	Ser	Val	Val	Gly 55	Thr	Lys	Thr	Gly	Ile 60	Gly	Ala	Tyr	Val
Ala 65	Thr	Asp	Asn	Ala	Arg 70	Lys	Glu	Ile	Val	Val 75	Ser	Val	Arg	Gly	Ser 80
Ile	Asn	Val	Arg	Asn 85	Trp	Ile	Thr	Asn	Phe 90	Asn	Phe	Gly	Gln	Lys 95	Thr
Cys	Asp	Leu	Val 100	Ala	Gly	Cys	Gly	Val 105	His	Thr	Gly	Phe	Leu 110	Asp	Ala
Trp	Glu	Glu 115	Val	Ala	Ala	Asn	Val 120	Lys	Ala	Ala	Val	Ser 125	Ala	Ala	Lys
Thr	Ala 130	Asn	Pro	Thr	Phe	Lys 135	Phe	Val	Val	Thr	Gly 140	His	Ser	Leu	Gly
Gly 145	Ala	Val	Ala	Thr	Ile 150	Ala	Ala	Ala	Tyr	Leu 155	Arg	Lys	Asp	Gly	Phe 160
Pro	Phe	Asp	Leu	Tyr 165	Thr	Tyr	Gly	Ser	Pro 170	Arg	Val	Gly	Asn	Asp 175	Phe
Phe	Ala	Asn	Phe 180	Val	Thr	Gln	Gln	Thr 185	Gly	Ala	Glu	Tyr	Arg 190	Val	Thr
His	Gly	Asp 195	Asp	Pro	Val	Pro	Arg 200	Leu	Pro	Pro	Ile	Val 205	Phe	Gly	Tyr
Arg	His 210	Thr	Ser	Pro	Glu	Tyr 215	Trp	Leu	Asn	Gly	Gly 220	Pro	Leu	Asp	Lys

Asp Tyr Thr Val Thr Glu Ile Lys Val Cys Glu Gly Ile Ala Asn Val  
 225 230 235 240

Met Cys Asn Gly Gly Thr Ile Gly Leu Asp Ile Leu Ala His Ile Thr  
 245 250 255

Tyr Phe Gln Ser Met Ala Thr Cys Ala Pro Ile Ala Ile Pro Trp Lys  
 260 265 270

Arg

<210> 10  
 <211> 278  
 <212> PRT  
 <213> *Aspergillus oryzae*

<400> 10

Asp Ile Pro Thr Thr Gln Leu Glu Asp Phe Lys Phe Trp Val Gln Tyr  
 1 5 10 15

Ala Ala Ala Thr Tyr Cys Pro Asn Asn Tyr Val Ala Lys Asp Gly Glu  
 20 25 30

Lys Leu Asn Cys Ser Val Gly Asn Cys Pro Asp Val Glu Ala Ala Gly  
 35 40 45

Ser Thr Val Lys Leu Ser Phe Ser Asp Asp Thr Ile Thr Asp Thr Ala  
 50 55 60

Gly Phe Val Ala Val Asp Asn Thr Asn Lys Ala Ile Val Val Ala Phe  
 65 70 75 80

Arg Gly Ser Tyr Ser Ile Arg Asn Trp Val Thr Asp Ala Thr Phe Pro  
 85 90 95

Gln Thr Asp Pro Gly Leu Cys Asp Gly Cys Lys Ala Glu Leu Gly Phe  
 100 105 110

Trp Thr Ala Trp Lys Val Val Arg Asp Arg Ile Ile Lys Thr Leu Asp  
 115 120 125

Glu Leu Lys Pro Glu His Ser Asp Tyr Lys Ile Val Val Val Gly His  
 130 135 140

Ser Leu Gly Ala Ala Ile Ala Ser Leu Ala Ala Ala Asp Leu Arg Thr  
 145 150 155 160

Lys Asn Tyr Asp Ala Ile Leu Tyr Ala Tyr Ala Ala Pro Arg Val Ala  
 165 170 175

Asn Lys Pro Leu Ala Glu Phe Ile Thr Asn Gln Gly Asn Asn Tyr Arg  
 180 185 190

Phe Thr His Asn Asp Asp Pro Val Pro Lys Leu Pro Leu Leu Thr Met  
 195 200 205

Gly Tyr Val His Ile Ser Pro Glu Tyr Tyr Ile Thr Ala Pro Asp Asn  
 210 215 220

Thr Thr Val Thr Asp Asn Gln Val Thr Val Leu Asp Gly Tyr Val Asn  
 225 230 235 240

Phe Lys Gly Asn Thr Gly Thr Ser Gly Gly Leu Pro Asp Leu Leu Ala  
 245 250 255

Phe His Ser His Val Trp Tyr Phe Ile His Ala Asp Ala Cys Lys Gly  
 260 265 270

Pro Gly Leu Pro Leu Arg  
 275

<210> 11  
 <211> 278  
 <212> PRT  
 <213> Penicillium camemberti

<400> 11

Asp Val Ser Thr Ser Glu Leu Asp Gln Phe Glu Phe Trp Val Gln Tyr  
 1 5 10 15

Ala Ala Ala Ser Tyr Tyr Glu Ala Asp Tyr Thr Ala Gln Val Gly Asp  
 20 25 30

Lys Leu Ser Cys Ser Lys Gly Asn Cys Pro Glu Val Glu Ala Thr Gly  
 35 40 45

Ala Thr Val Ser Tyr Asp Phe Ser Asp Ser Thr Ile Thr Asp Thr Ala  
50 55 60

Gly Tyr Ile Ala Val Asp His Thr Asn Ser Ala Val Val Leu Ala Phe  
65 70 75 80

Arg Gly Ser Tyr Ser Val Arg Asn Trp Val Ala Asp Ala Thr Phe Val  
85 90 95

His Thr Asn Pro Gly Leu Cys Asp Gly Cys Leu Ala Glu Leu Gly Phe  
100 105 110

Trp Ser Ser Trp Lys Leu Val Arg Asp Asp Ile Ile Lys Glu Leu Lys  
115 120 125

Glu Val Val Ala Gln Asn Pro Asn Tyr Glu Leu Val Val Val Gly His  
130 135 140

Ser Leu Gly Ala Ala Val Ala Thr Leu Ala Ala Thr Asp Leu Arg Gly  
145 150 155 160

Lys Gly Tyr Pro Ser Ala Lys Leu Tyr Ala Tyr Ala Ser Pro Arg Val  
165 170 175

Gly Asn Ala Ala Leu Ala Lys Tyr Ile Thr Ala Gln Gly Asn Asn Phe  
180 185 190

Arg Phe Thr His Thr Asn Asp Pro Val Pro Lys Leu Pro Leu Leu Ser  
195 200 205

Met Gly Tyr Val His Val Ser Pro Glu Tyr Trp Ile Thr Ser Pro Asn  
210 215 220

Asn Ala Thr Val Ser Thr Ser Asp Ile Lys Val Ile Asp Gly Asp Val  
225 230 235 240

Ser Phe Asp Gly Asn Thr Gly Thr Gly Leu Pro Leu Leu Thr Asp Phe  
245 250 255

Glu Ala His Ile Trp Tyr Phe Val Gln Val Asp Ala Gly Lys Gly Pro  
260 265 270

Gly Leu Pro Phe Lys Arg

275

<210> 12  
 <211> 270  
 <212> PRT  
 <213> Aspergillus foetidus

<400> 12

Ser Val Ser Thr Ser Thr Leu Asp Glu Leu Gln Leu Phe Ala Gln Trp  
 1 5 10 15

Ser Ala Ala Ala Tyr Cys Ser Asn Asn Ile Asp Ser Lys Asp Ser Asn  
 20 25 30

Leu Thr Cys Thr Ala Asn Ala Cys Pro Ser Val Glu Glu Ala Ser Thr  
 35 40 45

Thr Met Leu Leu Glu Phe Asp Leu Thr Asn Asp Phe Gly Gly Thr Ala  
 50 55 60

Gly Phe Leu Ala Ala Asp Asn Thr Asn Lys Arg Leu Val Val Ala Phe  
 65 70 75 80

Arg Gly Ser Ser Thr Ile Glu Asn Trp Ile Ala Asn Leu Asp Phe Ile  
 85 90 95

Leu Glu Asp Asn Asp Asp Leu Cys Thr Gly Cys Lys Val His Thr Gly  
 100 105 110

Phe Trp Lys Ala Trp Glu Ser Ala Ala Asp Glu Leu Thr Ser Lys Ile  
 115 120 125

Lys Ser Ala Met Ser Thr Tyr Ser Gly Tyr Thr Leu Tyr Phe Thr Gly  
 130 135 140

His Ser Leu Gly Gly Ala Leu Ala Thr Leu Gly Ala Thr Val Leu Arg  
 145 150 155 160

Asn Asp Gly Tyr Ser Val Glu Leu Tyr Thr Tyr Gly Cys Pro Arg Ile  
 165 170 175

Gly Asn Tyr Ala Leu Ala Glu His Ile Thr Ser Gln Gly Ser Gly Ala  
 180 185 190



Asn Phe Arg Val Thr His Leu Asn Asp Ile Val Pro Arg Val Pro Pro  
 195 200 205

Met Asp Phe Gly Phe Ser Gln Pro Ser Pro Glu Tyr Trp Ile Thr Ser  
 210 215 220

Gly Asn Gly Ala Ser Val Thr Ala Ser Asp Ile Glu Val Ile Glu Gly  
 225 230 235 240

Ile Asn Ser Thr Ala Gly Asn Ala Gly Glu Ala Thr Val Ser Val Leu  
 245 250 255

Ala His Leu Trp Tyr Phe Phe Ala Ile Ser Glu Cys Leu Leu  
 260 265 270

<210> 13  
 <211> 270  
 <212> PRT  
 <213> Aspergillus niger

<400> 13

Ser Val Ser Thr Ser Thr Leu Asp Glu Leu Gln Leu Phe Ser Gln Trp  
 1 5 10 15

Ser Ala Ala Ala Tyr Cys Ser Asn Asn Ile Asp Ser Asp Asp Ser Asn  
 20 25 30

Val Thr Cys Thr Ala Asp Ala Cys Pro Ser Val Glu Glu Ala Ser Thr  
 35 40 45

Lys Met Leu Leu Glu Phe Asp Leu Thr Asn Asn Phe Gly Gly Thr Ala  
 50 55 60

Gly Phe Leu Ala Ala Asp Asn Thr Asn Lys Arg Leu Val Val Ala Phe  
 65 70 75 80

Arg Gly Ser Ser Thr Ile Lys Asn Trp Ile Ala Asp Leu Asp Phe Ile  
 85 90 95

Leu Gln Asp Asn Asp Asp Leu Cys Thr Gly Cys Lys Val His Thr Gly  
 100 105 110

Phe Trp Lys Ala Trp Glu Ala Ala Ala Asp Asn Leu Thr Ser Lys Ile

115		120		125
Lys Ser Ala Met Ser Thr Tyr Ser Gly Tyr Thr Leu Tyr Phe Thr Gly				
130		135		140
His Ser Leu Gly Gly Ala Leu Ala Thr Leu Gly Ala Thr Val Leu Arg				
145		150		155
				160
Asn Asp Gly Tyr Ser Val Glu Leu Tyr Thr Tyr Gly Cys Pro Arg Val				
		165		170
				175
Gly Asn Tyr Ala Leu Ala Glu His Ile Thr Ser Gln Gly Ser Gly Ala				
		180		185
				190
Asn Phe Pro Val Thr His Leu Asn Asp Ile Val Pro Arg Val Pro Pro				
		195		200
				205
Met Asp Phe Gly Phe Ser Gln Pro Ser Pro Glu Tyr Trp Ile Thr Ser				
		210		215
				220
Gly Thr Gly Ala Ser Val Thr Ala Ser Asp Ile Glu Leu Ile Glu Gly				
		225		230
				235
				240
Ile Asn Ser Thr Ala Gly Asn Ala Gly Glu Ala Thr Val Asp Val Leu				
		245		250
				255
Ala His Leu Trp Tyr Phe Phe Ala Ile Ser Glu Cys Leu Leu				
		260		265
				270
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<211> 269				
<212> PRT				
<213> Aspergillus oryzae				
<400> 14				
Asp Val Ser Ser Ser Leu Leu Asn Asn Leu Asp Leu Phe Ala Gln Tyr				
1		5		10
				15
Ser Ala Ala Ala Tyr Cys Asp Glu Asn Leu Asn Ser Thr Gly Thr Lys				
		20		25
				30
Leu Thr Cys Ser Val Gly Asn Cys Pro Leu Val Glu Ala Ala Ser Thr				
		35		40
				45

Gln Ser Leu Asp Glu Phe Asn Glu Ser Ser Ser Tyr Gly Asn Pro Ala  
50 55 60

Gly Tyr Leu Ala Ala Asp Glu Thr Asn Lys Leu Leu Val Leu Ser Phe  
65 70 75 80

Arg Gly Ser Ala Asp Leu Ala Asn Trp Val Ala Asn Leu Asn Phe Gly  
85 90 95

Leu Glu Asp Ala Ser Asp Leu Cys Ser Gly Cys Glu Val His Ser Gly  
100 105 110

Phe Trp Lys Ala Trp Ser Glu Ile Ala Asp Thr Ile Thr Ser Lys Val  
115 120 125

Glu Ser Ala Leu Ser Asp His Ser Asp Tyr Ser Leu Val Leu Thr Gly  
130 135 140

His Ser Tyr Gly Ala Ala Leu Ala Ala Leu Ala Ala Thr Ala Leu Arg  
145 150 155 160

Asn Ser Gly His Ser Val Glu Leu Tyr Asn Tyr Gly Gln Pro Arg Leu  
165 170 175

Gly Asn Glu Ala Leu Ala Thr Tyr Ile Thr Asp Gln Asn Lys Gly Gly  
180 185 190

Asn Tyr Arg Val Thr His Thr Asn Asp Ile Val Pro Lys Leu Pro Pro  
195 200 205

Thr Leu Leu Gly Tyr His His Phe Ser Pro Glu Tyr Tyr Ile Ser Ser  
210 215 220

Ala Asp Glu Ala Thr Val Thr Thr Thr Asp Val Thr Glu Val Thr Gly  
225 230 235 240

Ile Asp Ala Thr Gly Gly Asn Asp Gly Thr Asp Gly Thr Ser Ile Asp  
245 250 255

Ala His Arg Trp Tyr Phe Ile Tyr Ile Ser Glu Cys Ser  
260 265

**Figure 1.****Alignment of fungal lipolytic enzyme sequences**

	1		50	
SEQ ID NO: 1	.....	EVSQDLFNQF NLFAQYSAAA	.....YCG KNNDAPAGTN	33
SEQ ID NO: 2	.....AV	GVTTFDFS NF KFYIQHGAAA	.....YC. .NSEAAAGSK	33
SEQ ID NO: 3	SSSTQDYRI	ASEAEIKAHT FYTALSANA.	.....YCR TVIPG.....	
SEQ ID NO: 4	.SSSTQDYRI	ASEAEIKAHT FYTALSANA.	.....YCR TVIPG.....	
SEQ ID NO: 5	.SIDGGIRA	ATSQEINELT YYTTLANS.	.....YCR TVIPG.....	
SEQ ID NO: 6	.SASDGGKV	AATTAQIQEF TKYAGIAATA	.....YCR SVVPG.....	
SEQ ID NO: 7	....TAGQAL	AASTQ.GISE DLYNRL.VEM	ATISQAAYAD LCNIPST...	
SEQ ID NO: 8	....TAGHAL	AASTQ.GISE DLYSRL.VEM	ATISQAAYAD LCNIPST...	
SEQ ID NO: 9	.....	TVTTQDLSNF RFYLQHADA	.....YC. .NFNTAVGKP	
SEQ ID NO: 10	.....	DIPTTQLEDF KFWVQYAAAT	.....YCP NNYVAKDGEK	
SEQ ID NO: 11	.....	DVSTSELDQF EFWVQYAAAS	.....YYE ADYTAQVGDK	
SEQ ID NO: 12	.....	SVSTSTLDEL QLFAQWSAAA	.....YCS NNID.SKDSN	
SEQ ID NO: 13	.....	SVSTSTLDEL QLFSQWSAAA	.....YCS NNID.SDDSN	
SEQ ID NO: 14	.....	DVSSSLNLL DLFAQYSAAA	.....YCD ENLN.STGTK	
	51		100	
SEQ ID NO: 1	ITCTGNACPE	VEKADATFLY SFE.DSGVGD	VTGFLALDNT NKLIVLSFRG	82
SEQ ID NO: 2	ITCSNNGCPT	VQNGGATIVT SF..VGSKTG	IGGYVATDSA RKEIVVSFRG	81
SEQ ID NO: 3	GRWSCPHCGV	AS..NLQITK TFST..LITD	TNVLVAVGEK EKTIVVFRG	
SEQ ID NO: 4	GQWSCPHCDV	AP..NLNITK TFFT..LITD	TNVLVAVGEN EKTIVVFRG	
SEQ ID NO: 5	ATWDCIHCD	TE..DLKIIK TWST..LIYD	TNAMVARGDS EKTIVVFRG	
SEQ ID NO: 6	NKWDCVQCQK	WVP.DGKIIT TFTS..LLSD	TNGYVLRSDK QKTIYLVFRG	
SEQ ID NO: 7	.....	.....IIK GEKIYNAQTD	INGWILRDDT SKEIITVFRG	
SEQ ID NO: 8	.....	.....IIK GEKIYNSQTD	INGWILRDDT SKEIITVFRG	
SEQ ID NO: 9	VHCSAGNCPD	IEKDAAIVVG SV..VGTKTG	IGAYVATDNA RKEIVVSVRG	
SEQ ID NO: 10	LNCSVGNCPD	VEAAGSTVKL SFS.DDTITD	TAGFVAVDNT NKAIVVAFRG	
SEQ ID NO: 11	LSCSKGNCPD	VEATGATVSY DFS.DSTITD	TAGYIAVDHT NSAVVLAFRG	
SEQ ID NO: 12	LTCTANACPS	VEEASTTMLL EFDLTNDFGG	TAGFLAADNT NKRLVVAFRG	
SEQ ID NO: 13	VTCTADACPS	VEEASTKMLL EFDLTNNFGG	TAGFLAADNT NKRLVVAFRG	
SEQ ID NO: 14	LTCSVGNCPD	VEAASTQSLD EFNESSTSYGN	PAGYLAADET NKLLVLSFRG	
	101		150	
SEQ ID NO: 1	SRSIENWIGN	LNFDLKEIND I..CSGCRGH	DGFTSSWRSV ADTLRQKVED	130
SEQ ID NO: 2	SINIRNWLTN	LDFG.QEDCS L..VSGCGVH	SGFQRAWNEI SSQATAAVAS	128
SEQ ID NO: 3	TSSIRNAIAD	IVFVPVNYPP V...NGAKVH	KGFLDSYNEV QDKLVAEVKA	
SEQ ID NO: 4	TSSIRNAIAD	IVFVPVNYPP V...NGAKVH	KGFLDSYNEV QDKLVAEVKA	
SEQ ID NO: 5	SSSIRNWIAD	LTFVPVSYP V...SGTKVH	KGFLDSYGEV QNELVATVLD	
SEQ ID NO: 6	TNSFRSAITD	IVFNFSYDYP V...KGAKVH	AGFLSSYEQV VNDYFPVVQE	
SEQ ID NO: 7	TGSDTNLQLD	TNYTLTPFDT LPQCNDCEVH	GGYYIGWISV QDQVESLVKQ	
SEQ ID NO: 8	TGSDTNLQLD	TNYTLTPFDT LPQCNSCEVH	GGYYIGWISV QDQVESLVKQ	
SEQ ID NO: 9	SINVRNWITN	FNFG.QKTC L..VAGCGVH	TGFLDAWEEV AANVKA AVSA	
SEQ ID NO: 10	SYSIRNWVTD	ATFP.QTDPG L..CDGCKAE	LGFWTAWKV RDRIIKTLDE	
SEQ ID NO: 11	SYSVRNWVAD	ATFV.HTNPG L..CDGCLAE	LGFWSSWKL RDDI IKELKE	
SEQ ID NO: 12	SSTIENWIAN	LDFILEDNDD L..CTGCKVH	TGFWKAWESA ADELTSKIKS	
SEQ ID NO: 13	SSTIKNWIAD	LDFILQDND L..CTGCKVH	TGFWKAWESA ADNLTSKIKS	
SEQ ID NO: 14	SADLANWVAN	LNFGLEDASD L..CSGCEVH	SGFWKAWSEI ADTITSKVES	
	151		200	
SEQ ID NO: 1	AVREHPDYRV	VFTGHS LGGA LATVAGADLR	GNGY.....D IDVFSYGAPR	175
SEQ ID NO: 2	ARKANPSFNV	ISTGHS LGGA VAVLAANLR	VGGT.....P VDIYTYGSPR	173
SEQ ID NO: 3	QLDRHPGYKI	VVTGHS LGGA TAVLSALDLY	HHGHA....N IEIYTQGQPR	
SEQ ID NO: 4	QLDRHPGYKI	VVTGHS LGGA TAVLSALDLY	HHGHD....N IEIYTQGQPR	
SEQ ID NO: 5	QFKQYPSYKV	AVTGHS LGGA TALLCALDLY	QREGLSSSN LFLYTQGQPR	
SEQ ID NO: 6	QLTAHPTYKV	IVTGHS LGGA QALLAGMDLY	QREPLSPKN LSIFTVGGPR	
SEQ ID NO: 7	QASQYPDYAL	TVTGHSLGAS MAALTAAQL.	SATYD....N VRLYTFGEPR	
SEQ ID NO: 8	QVSQFPDYAL	TVTGHSLGAS LAALTAAQL.	SATYD....N IRLYTFGEPR	
SEQ ID NO: 9	AKTANPTFKF	VVTGHS LGGA VATIAAAYLR	KDGF.....P FDLYTYGSPR	
SEQ ID NO: 10	LKPEHSDYKI	VVVGHS LGGA IASLAAADLR	TKNY.....D AILYAYAAPR	

Fig. 1 cont.

SEQ ID NO: 11	VVAQNPNYEL	VVVGHSLGAA	VATLAATDLR	GKGYP....S	AKLYAYASPR	
SEQ ID NO: 12	AMSTYSGYTL	YFTGHSLGGA	LATLGATVLR	NDGY.....S	VELYTYGCPR	
SEQ ID NO: 13	AMSTYSGYTL	YFTGHSLGGA	LATLGATVLR	NDGY.....S	VELYTYGCPR	
SEQ ID NO: 14	ALSDHSDYSL	VLTGHSYGAA	LAALAATALR	NSGH.....S	VELYNYGQPR	
	201				250	
SEQ ID NO: 1	VGNRAFAEFL	TVQ.....T	GGTLYRITHT	NDIVPRLPPR	EFGYSHSSPE	219
SEQ ID NO: 2	VGNAQLSAFV	SNQ.....	AGGEYRVTHA	DDPVPRLPPL	IFGYRHTTPE	216
SEQ ID NO: 3	IGTPAFANYV	IGT.....	KIPYQRLVHE	RDIVPHLPPG	AFGFLHAGEE	
SEQ ID NO: 4	IGTPEFANYV	IGT.....	KIPYQRLVNE	RDIVPHLPPG	AFGFLHAGEE	
SEQ ID NO: 5	VGDPAFANYV	VST.....	GIPYRRTVNE	RDIVPHLPPA	AFGFLHAGEE	
SEQ ID NO: 6	VGNPTFAYYV	EST.....	GIPFQRTVHK	RDIVPHVPPQ	SFGFLHPGVE	
SEQ ID NO: 7	SGNQAFASYM	NDAFQVSSPE	TTQYFRVTHS	NDGIPNLPPA	DEGYAHGGVE	
SEQ ID NO: 8	S.NQAFASYM	NDAFQASSPD	TTQYFRVTHA	NDGIPNLPPA	DEGYAHGVVE	
SEQ ID NO: 9	VGNDFFANFV	TQQ.....	TGAEYRVTHG	DDPVPRLPPI	VFGYRHTSPE	
SEQ ID NO: 10	VANKPLAEFI	TNQ.....	.GNNYRFTHN	DDPVPKLPLL	TMGYVHISPE	
SEQ ID NO: 11	VGNAALAKYI	TAQ.....	.GNNFRFTHT	NDPVPKLPLL	SMGYVHVSPE	
SEQ ID NO: 12	IGNYALAEHI	TSQ.....G	SGANFRVTHL	NDIVPRVPPM	DFGFSQPSPE	
SEQ ID NO: 13	VGNYALAEHI	TSQ.....G	SGANFPVTHL	NDIVPRVPPM	DFGFSQPSPE	
SEQ ID NO: 14	LGNEALATYI	TDQ.....N	KGGNYRVTHT	NDIVPKLPPT	LLGYHHFSPE	
	251				300	
SEQ ID NO: 1	YWIKS..GTL	VPVTRNDIVK	IEGIDATG.G	NNQPNIP...	DIPAH LWYF.	262
SEQ ID NO: 2	FWLSGGGGDK	VDYTISDVKV	CEGAANLG.C	NGGTLGL...	DIAAHLHYF.	261
SEQ ID NO: 3	FWIMK.....	....DSSLRV	CPNGIETDNC	SNSIVPFT..	SVIDHLSYLD	
SEQ ID NO: 4	FWIMK.....	....DSSLRV	CPNGIETDNC	SNSIVPFT..	SVIDHLSYLD	
SEQ ID NO: 5	YWITD.....	..NSPETVQV	CTSDLETSDC	SNSIVPFT..	SVDHLSYFG	
SEQ ID NO: 6	SWIKS.....	...GTSNVQI	CTSEIETKDC	SNSIVPFT..	SILDHLSYFD	
SEQ ID NO: 7	YWSV....DP	YSAQNTFVCT	GDEVQCCE.A	QGGQGVN...	..DAHTTYF.	
SEQ ID NO: 8	YWSV....DP	YSAQNTFVCT	GDEVQCCE.A	QGGQGVN...	..NAHTTYF.	
SEQ ID NO: 9	YWLNG.GPLD	KDYTVTEIKV	CEGIANVM.C	NGGTIGL...	DILAHITYF.	
SEQ ID NO: 10	YYITA..PDN	TTVTDNQVTV	LDGYVNFK.G	NTGTSGGLPD	LLAFHSHVWY	
SEQ ID NO: 11	YWITS..PNN	ATVSTSDIKV	IDGDVSFD.G	NTGTGLPLLT	DFAHIWYF.	
SEQ ID NO: 12	YWITS..GNG	ASVTASDIEV	IEGINSTA.G	NAGEATV...	SVLAHLWYF.	
SEQ ID NO: 13	YWITS..GTG	ASVTASDIEL	IEGINSTA.G	NAGEATV...	DVLAHLWYF.	
SEQ ID NO: 14	YYISS..ADE	ATVTTTDVTE	VTGIDATG.G	NDGTDGT...	SIDAH RWYF.	
	301				350	
SEQ ID NO: 1	GLIGT.CL..	.....	.....	.....	.....	269
SEQ ID NO: 2	QATDA.CNAG	GFS.....	.....	.....	.....	286
SEQ ID NO: 3	MNTGL.CL..	.....	.....	.....	.....	
SEQ ID NO: 4	MNTGL.CL..	.....	.....	.....	.....	
SEQ ID NO: 5	INTGL.CT..	.....	.....	.....	.....	
SEQ ID NO: 6	INEGS.CL..	.....	.....	.....	.....	
SEQ ID NO: 7	GMTSGACTW.	.....	.....	.....	.....	
SEQ ID NO: 8	GMTSGHCTW					
SEQ ID NO: 9	QSMAT.CAPI	AIPWKR....	.....	.....	.....	
SEQ ID NO: 10	FIHADACKGP	GLPLR....	.....	.....	.....	
SEQ ID NO: 11	VQVDAGKGP	LPFKR....	.....	.....	.....	
SEQ ID NO: 12	FAISE.CLL.	.....	.....	.....	.....	
SEQ ID NO: 13	FAISE.CLL.	.....	.....	.....	.....	
SEQ ID NO: 14	IYISE.CS..	.....	.....	.....	.....	